

MJB4₊

MANUAL MASK ALIGNER

QUALITY MEETS INNOVATION



The MJB4 Mask Aligner from SUSS MicroTec is the perfect system for research institutes, universities and small volume production. Easy to use and compact in size, the SUSS MJB4 has set industry standards specifically for processing of small wafers/substrates or pieces and offers an ideal and cost-effective solution for customers with limited budgets.

Equipped with a reliable, high precision alignment and high resolution printing capability in the submicron range the MJB4 demonstrates a performance unsurpassed by any other comparable machine. The MJB4 is widely used for MEMS and optoelectronics applications. It can be configured for UV-Nanoimprint Lithography (UV-NIL) applications and non-standard substrates such as hybrids, high-frequency components for fragile III-V materials.

FEATURES AND BENEFITS

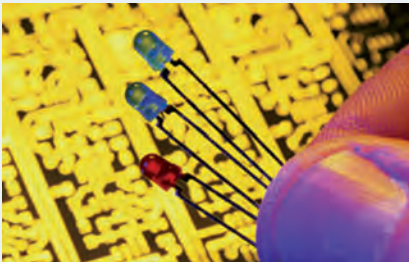
- + Fast and highly accurate alignment with SUSS Singlefield or Splitfield microscope
- + HR Optics enables high resolution prints down to $0.5\ \mu\text{m}$
- + The universal optics option (UV250/300/400) for fast switching between different wavelengths
- + Wafer and substrate handling up to 100 mm
- + Upgradable with a UV-Nanoimprint Lithography toolkit



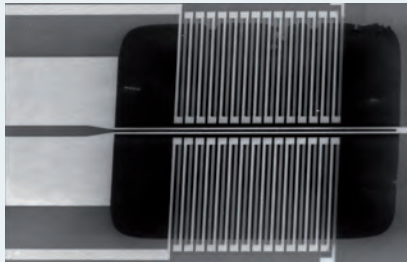
INDUSTRY LEADERSHIP THROUGH R&D AND SMALL VOLUME PRODUCTION

SUSS MicroTec maintains its market leadership in mask aligner technology based on innovative processes and technological excellence. The SUSS MJB4 Mask Aligner stands for the most versatile and flexible aligner solution available for small scale laboratory applications. MJB4 offers customized solutions for handling

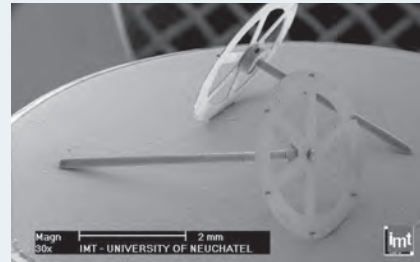
standard and non-standard substrates, like fragile compound semiconductors, glass, foils, as well as warped and drilled substrates. Therefore a variety of chucks and mask holders are available as an option that can be easily adapted to the process required.



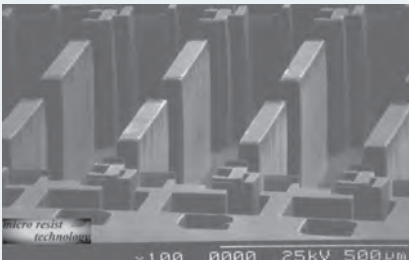
The MJB4 is used for lithography of LED.



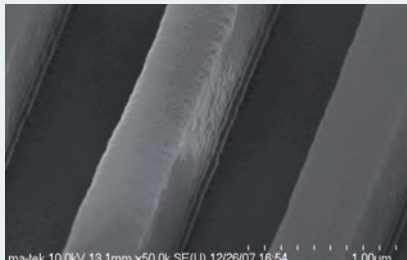
Microfluidics device
Courtesy: IMSAS, Bremen



Piezo motor for MEMS applications
Courtesy: IMT, University of Neuchatel



Structures with steep sidewalls manufactured in 100 to 200µm thick SU8 resist.
Courtesy: mrt, Berlin



Reliable submicron patterning with MJB4 diffraction reducing optics. 0.6µm resolution at 0.8µm resist thickness.



UV-NIL: 50nm, 70nm lines and spaces imprinted with MJB4 Mask Aligner

MICROSCOPES

Singlefield Microscope

Cost-effective solution for alignment of small wafers/substrates.

Splitfield Microscope with eye-pieces

Offers the operator a larger field of view, and an easy, simultaneous alignment of mask and wafer also at the wafer edge.

Video Microscope

System with eye-pieces and CCD camera system. Combined with the Splitfield Microscope it offers highest alignment accuracy and enables a precise alignment check.

MJB4 R&D SOLUTIONS – KEEPING YOU ON TOP

The SUSS MicroTec commitment to supporting a large number of research and development efforts underscores our dedication to providing technological innovation. The MJB4 is a cost-effective but highly flexible and efficient state-of-the-art mask aligner solution for all kinds of R&D applications. It represents an excellent platform for researchers to develop new processes and technologies on a highly versatile, state-of-the-art mask aligner platform.

EASY AND QUICK CHANGEOVER

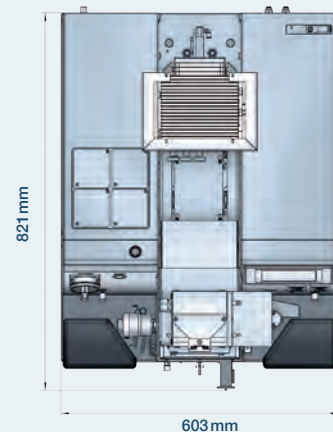
MJB4 allows for extremely quick changeover between different wafer sizes. Only chuck and maskholder need to be exchanged, which are easy accessible to the operator. Trained operators can do the wafer size changeover in less than 5 minutes.

EASY SOFTWARE

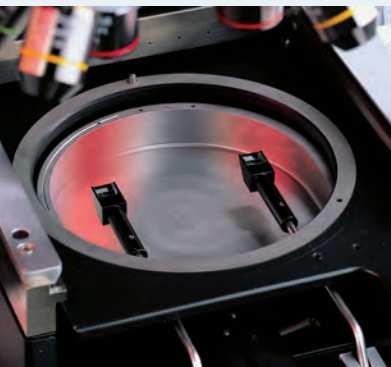
With its ergonomic operation and its elegant, touch panel based user interface the MJB4 is very easy to operate and only requires minimum operator training.

SMALL FOOTPRINT

In the MJB4 maximum functionality is packaged into minimal space. With a footprint of less than 0.5m² the MJB4 requires only minimum clean-room space.



Alignment Methods



TOP SIDE ALIGNMENT (TSA)

The MJB4 can be equipped with a manual Topside Alignment system.

INFRARED ALIGNMENT (IR)

allows the handling of opaque, IR-transparent materials such as GaAs, InP, Silicon or adhesives, as used for thin wafer handling or encapsulation applications.

IR ALIGNMENT SYSTEM

- + Infrared light source to be positioned manually
- + Special IR chucks available
- + Dedicated IR objectives
- + Singlefield (M500 or Splitfield (M604) video microscopes for wavelengths from 400 to 1200 nm

EXPOSURE SYSTEM

DIFFRACTION REDUCING EXPOSURE OPTICS

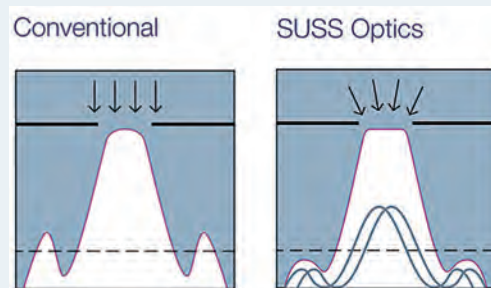
All SUSS Mask Aligners are using well established diffraction reducing illumination optics designed to compensate diffraction effects in contact and proximity lithography. In a SUSS MicroTec Mask Aligner, the photomask is not just simply illuminated with a plane wave, but with an annular spectrum of planar waves to reduce higher diffraction orders. The diffraction reducing exposure optics from SUSS MicroTec significantly improves resolution and sidewall profiles.

SUSS Diffraction Reducing Exposure Optics are available for the spectral ranges UV400, UV300 and UV250 and are able to significantly improve resolution and sidewall profiles.

DEDICATED OPTICS SOLUTIONS

The MJB4 is a full-field exposure system capable of exposing wafers and substrates up to 100mm as well as pieces.

SUSS MicroTec offers optimized solutions for dedicated spectral ranges such as UV250,

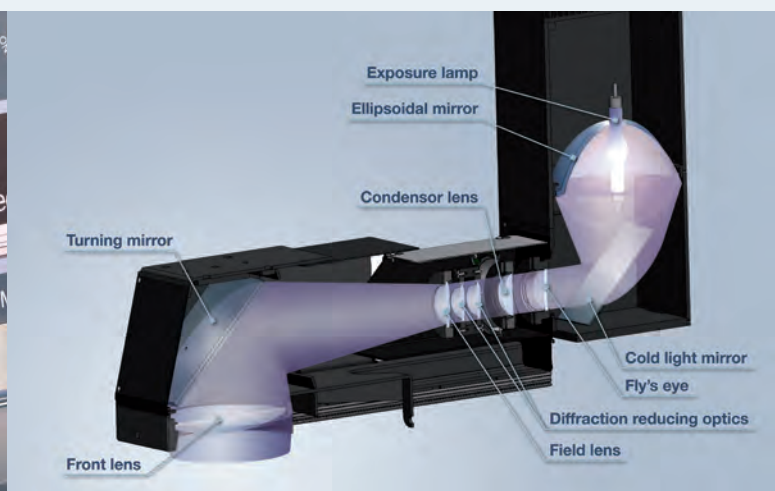


Strong diffraction effects from parallel illumination (graphics left) vs. SUSS Diffraction Reducing Optics (graphics right). SUSS MicroTec is the only semiconductor equipment supplier offering diffraction reducing optical setups.

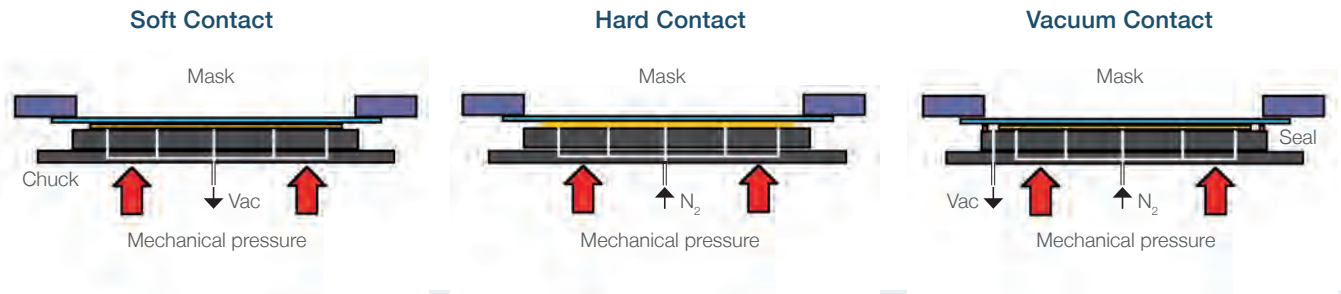
UV300 and UV400 to address different resolution requirements. All optics deliver optimum light uniformity of < 3%.

The combined SUSS Broadband Optics enables an easy switch between different applications and wavelengths without mechanical changeover. This unique new optics has been designed for UV250, UV300 and UV400 and offers broadband spectra, based on only one UV lamp.

The SUSS MO Exposure Optics is a new illumination concept based on 2 Köhler Integrators and combines highest uniformity with flexible illumination shaping. The exchangeable illumination filter plates allow for a quick and easy changeover between different optic types thereby enabling highest process flexibility.



Optical System of a SUSS MJB4 Mask Aligner



PRINTING MODES

The MJB4 is capable of handling several exposure sequences:

SOFT CONTACT

In soft contact mode the wafer is brought into contact with the mask and is fixed onto the chuck with vacuum. In this exposure mode the MJB4 can achieve a resolution of 2.0 μm .

HARD CONTACT

In hard contact mode the wafer is brought in direct contact with the mask, while positive nitrogen pressure is used to press the substrate against the mask. In hard contact mode a resolution in the 1 micron range is possible.

VACUUM CONTACT FOR HIGH PRECISION

In this mode, a vacuum is drawn between mask and substrate during exposure. This results in a high resolution of < 0.8 μm .

SOFT VACUUM CONTACT

For brittle or fragile substrates a soft vacuum contact exposure can be performed. The soft vacuum contact exposure mode reduces the vacuum impact to the substrate which leads to a high resolution not achievable in soft or hard contact.

PROXIMITY PRINTING

Although the MJB4 is not considered to be a proximity exposure system, the proximity printing mode allows exposure at a pre-set gap of up to 50 μm after initial wafer to mask leveling. This reduces mask damages, especially for larger feature sizes.

MJB4 RESOLUTION

EXPOSURE MODE	UV400	UV300	UV250
Vacuum Contact	< 0.8 μm	< 0.6 μm	< 0.5 μm
Hard Contact	1.0 μm	< 1.0 μm	-
Soft Contact	2.0 μm	< 2.0 μm	-
Gap Exposure	> 3.0 μm		

Line, Space resolution achieved in 1 μm thick resist AZ 4110 (UV400, UV300) and UV6 (UV250) respectively. Achievable resolution depends on wafer size, wafer flatness, resist type, clean room condition and therefore, might vary for different processes.

TECHNICAL DATA

MASK AND WAFER / SUBSTRATE

Wafer Size	1 up to 100mm / 4" (round)
Max. Substrate Size	100 x 100mm
Min. Pieces	5 x 5 mm
Wafer Thickness	up to 4 mm
Mask Size	standard 2" x 2" up to 5" x 5" (SEM)
Mask Thickness	up to 4.8mm / 190mil

EXPOSURE MODES

Contact: soft, hard, vacuum, soft vacuum
Vacuum contact adjustable to 200mbar abs
Gap exposure, adjustable gap 10 – 50µm
Flood exposure, split exposure
Lamp control modes: constant power, constant intensity

EXPOSURE OPTICS

RESOLUTION

Wavelength Range	UV400: 350 – 450 nm (g, h, i-line) UV 300: 280 – 350 nm UV 250: 240 – 260 nm UV 250 / 300 / 400: 240 – 450 nm
Exposure Source	CPC: Constant Power Controller for lamps Hg 200W and Hg 350W CiC1200: Constant Intensity Controller for lamps Hg 200W, Hg 350W and HgXE 500W (Deep UV)
Uniformity	≤ 3%

ALIGNMENT METHODS

Top Side Alignment (TSA) Accuracy	< 0.5µm (with SUSS recommended wafer targets)
Transmitted Infrared Alignment (IR) Accuracy	< 5µm (2µm under special process conditions)
Alignment Gap	10 – 50µm

ALIGNMENT STAGE

MA Movement Range	X: ± 5 mm Y: ± 5 mm Theta: ± 5°
Mechanical Resolution	X, Y: 0.1 µm Theta: 4 x 10 ⁻⁵

TOPSIDE MICROSCOPE (TSA)

Movement Range	X: ± 40 mm Y: + 30 – 50 mm Theta: ± 4°
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UTILITIES

Vacuum	< – 0.8bar < 200hPa abs
Compressed Air	5.5 bar (81 psi)
Nitrogen	> 1.5 bar (22 psi)

POWER REQUIREMENTS

Power Voltage	AC 230V ± 10 %
Frequency	50 – 60Hz

PHYSICAL DIMENSIONS

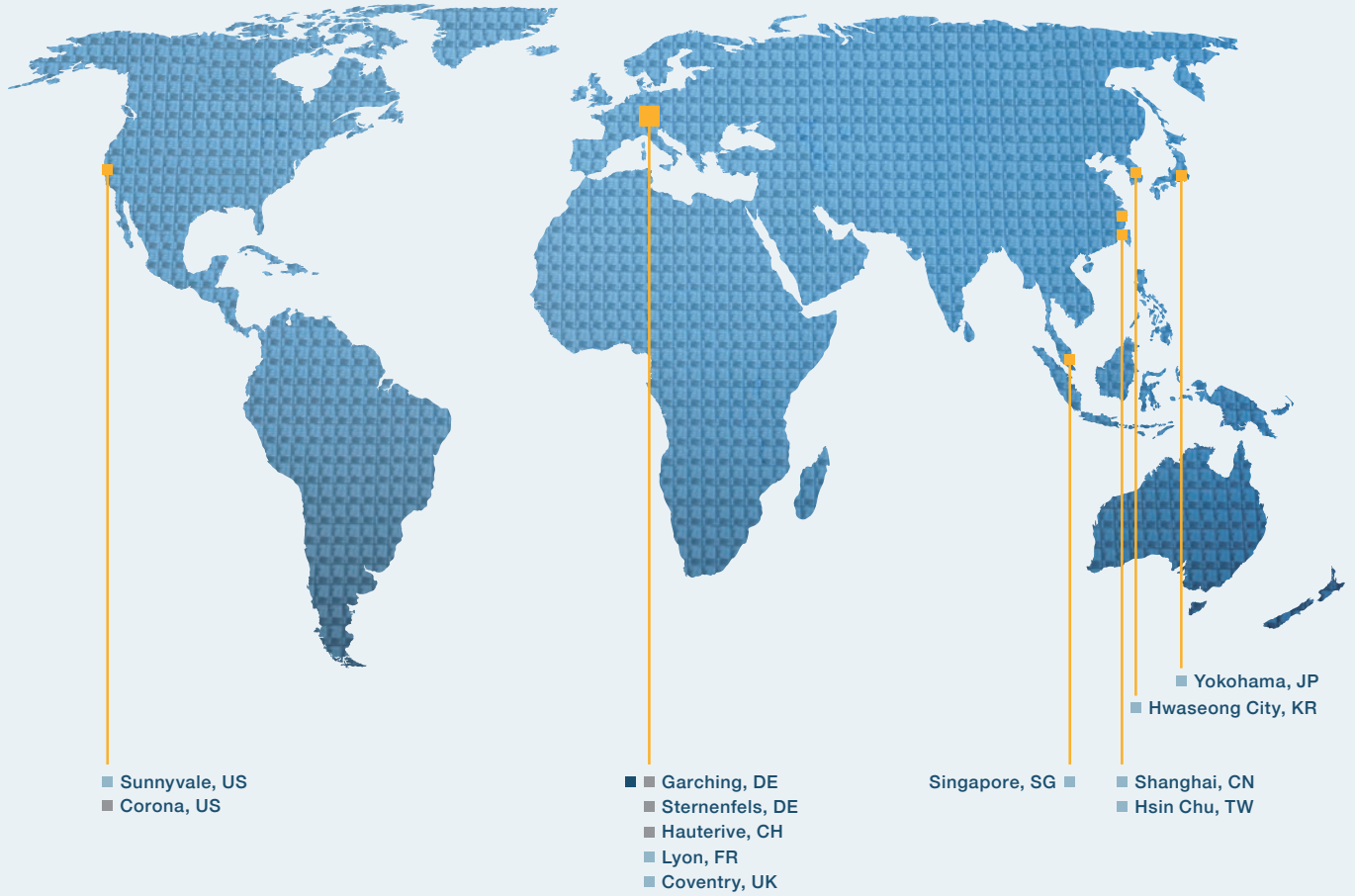
Width x Depth	605 x 810mm = 0.5m ²
Height	660mm
Weight	up to 130kg (290kg with antivibration table)
Operator Safety and Ergonomics	CE-mark, others on request Sound Pressure Level: < 70 db(A) UV radiation emissions (315 – 400nm): < 0.2mW/cm

Data, design and specification of custom built machines depend on individual process conditions and can vary according to equipment configurations. Not all specifications may be valid simultaneously. Illustrations in this brochure are not legally binding. SUSS MicroTec reserves the right to change machine specifications without prior notice.

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